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MINOR STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF VASSAR COLLEGE

XVIII. MEDIATE ASSOCIATIONS STUDIED BY THE METHOD OF INHIBITING ASSOCIATIONS: AN INSTANCE OF THE EFFECT OF *"Aufgabe"*

By M. VALERIE ATHERTON and M. F. WASHBURN

The term "mediate association" is one whose meaning seems to be differently apprehended by different writers. Titchener, in his recently published Textbook of Psychology, writes as follows: "Some psychologists believe that an association may be set up, originated, by unconscious (purely physiological) intermediaries. I examine a picture, we will say, which the artist has signed; my eyes travel over the signature, but I fail entirely to remark it. At some later time I am examining another picture, signed in the same way by the same artist; again my eyes travel over the signature, but again I fail to remark it. Nevertheless, the second picture suggests the first; the signature has impressed my brain, although it has not aroused a perception; the ideas of the two pictures are connected by this unconscious link. Here is a case of mediate association." This form of association Titchener thinks does not occur: "association requires attention." (*Op. cit. p.* 386).

Evidently what Titchener understands by mediate association is a case where the link (the artist's signature) which connects the two experiences (the two pictures) has never, *at any time,* been in focal consciousnss. The observer failed altogether to remark the artist's signature when it was originally presented to his sense of sight. Now an examination of the methods used by some of the investigators of mediate association will show that they could not possibly have understood the term in this sense. When Münsterberg,[1] for instance, presented two different words on two different occasions, with the same nonsense syllable accompanying them, in order to see whether the second word would suggest the first, he surely did not expect that the observer would not notice the nonsense syllable at all on either occasion. When Cordes[2] gave as the common *Nebenreiz* accompanying two words a tone, a perfume, or a weak electrical stimulus, he certainly did not suppose that the *Nebenreiz* would be unperceived or unattended to: he meant only to find whether it could constitute a link between the two words without being recognized as such. When Aschaffenburg[3] quotes as illustrations of the mediate associations he encountered in his experiments, such cases as the following: "Schnitt (Schlitten), Fahrt; Allmacht (alma), Mater," he did not for a moment think that the intermediate links

[1] H. Münsterberg: *Studien zur Associationslehre,* Beiträge zur Exp. Psychologie, I. 1893 (Heft 4), 1-39.

[2] G. Cordes: *Experimentelle Untersuchungen über Associationen,* Phil. Stud. XVII. 1901, 30.

[3] G. Aschaffenburg: *Experimentelle Studien über Associationen,* Psychol. Arbeiten (Kraepelin), I. 1896, 209-299.

had never in the past been consciously associated and attended to. A fair question with regard to the process of association is this: may process A suggest process B, both of them being conscious processes, by means of an intermediate process, C, which is not a conscious process at all, but exists only on the physiological level at the time when it functions to connect A and B, though it may quite well have been accompanied by consciousness on previous occasions?

As an example of the kind of mental event to which we would apply the term "mediate association," we may give the following: The observer was instructed on hearing a stimulus word to respond with a word which should be wholly unassociated with it. The stimulus word was "cane." It started immediately in the observer's mind the verbal series "sugar—south." This was interrupted by the remembrance of the instruction not to give associated words. The word "storm" then came, purely as an auditory-motor word. After it had been given, there developed in the observer's mind the memory idea, chiefly visual, of uprooted trees and signs of devastation by a storm, seen from a car window on a recent journey to the southward. That this memory had not been in consciousness at all during the interval between stimulus and reaction word the observer, who had had long practice in introspection, was sure.

The occurrence of associations whose mediation does not come into consciousness in any recognizable manner is certainly an interesting and well-attested phenomenon. We have undertaken to study it by a method which we believe to be new, and which furnishes in addition a good chance to observe the effect of a definite *Aufgabe* or task set the observer, in that the task here is directly opposed to the mental processes which would naturally occur in the circumstances if the task had not been set. The nature of this method has been already partly indicated. The observer was given the instruction that on hearing the stimulus word pronounced she was to respond by giving a word that had no association with it. She was further forbidden to take refuge in the too easy plan of giving a word suggested by any of the surrounding objects. She was not told to react as quickly as possible, but was allowed to take her own time. There were in all eleven observers, all women, but upon two of them only a few experiments were made.

In a certain number of cases the effect of these instructions was so to "set" the observer's mind that *the stimulus word did not start any associations at all.* "Thought of nothing at first;" "Stimulus had no effect at all;" "No associations with stimulus word;" "Stimulus just a word, auditory motor;" such are some of the statements describing this condition. For all the observers but one, A, cases of this kind occurred less frequently than those where the stimulus word started at least one or two associated ideas, *the train of associations being with effort broken off or inhibited.* These were the two ways in which the instructions were carried out. In a certain proportion of cases *the observer failed to carry out the instructions;* the reaction word was really connected with the stimulus word by a clearly realized chain of ideas, which the observer had found it impossible to inhibit. One observer, Cr., in the earlier experiments seemed to feel that she had carried out instructions if she followed the train of ideas started by the stimulus word far enough away to make the reaction word sound unassociated to one who did not know the intermediate links: thus with the stimulus word "match" she followed a train of ideas until she came in thought to a nail

on which her match box is hung, and gave "nail" as the reaction word. Practice overcame this tendency to a considerable extent. Under the head of failure to carry out instructions may also be classed the cases where the reaction word was given as unassociated when there was really a sound association between it and the stimulus word: the fact that they were unassociated in meaning seemed to make the reaction word elude the inhibiting influence of the *Aufgabe*. Thus for example take the following: "Stimulus word 'pearl,' reaction word 'puppy.' Introspection: 'no associations with stimulus word; the sound of p seems to have been the link.'" Or as another case: "Stimulus word 'curtain,' reaction word 'concert.' Introspection: 'No images. Concert came from sound suggestion of c.'"

These, then, were the typical methods of reacting to the stimulus word itself as a consequence of the instruction to answer with an unassociated word: either the stimulus word was, so far as the obse ver's introspection went, without any associative effect; or it started a train of ideas which was interrupted by recollection of the instructions; or the train of ideas was not inhibited, the instructions being wholly unfulfilled; or meaning associations were inhibited but sound associations persisted and determined the reaction word. We next have the question: How was the reaction word obtained in the cases where the instructions were carried out?

(1) In a considerable number of cases the reaction word was connected with some recent experience of the observer's. Thus for example: "Stimulus word 'easel,' reaction word 'oranges.' Introspection: 'Associated words and picture of Hudson River all inhibited: recent experience of seeing oranges came into mind.'" "Stimulus word 'path,' reaction word 'steamship.' Introspection: 'Visual and verbal images—bridle path, horse, O's brother—all inhibited. Visual image of picture of boat seen recently.'" One observer in particular, B, was especially given to this method of getting a reaction word, using it in 23% of 164 experiments. Observer Ab, on the other hand, furnished no instances of this type in the 72 experiments made with her. It may naturally be asked what determined attention to a particular recent experience rather than to others: why did the observer think precisely of the oranges she had recently seen and not of some other object lately experienced? The observers could give no answer at all to this question.

(2) Another device, closely akin to the one just described, by which a reaction word could be obtained that would escape inhibition by the *Aufgabe*, consisted in what the observers sometimes called "taking a walk." That is, the attention was drawn to memory ideas of the surroundings, usually the out-of-doors surroundings, of the room in which the experiments occurred. Since the observers were forbidden to get their reaction words from present objects, this was a kind of outward roaming in space, as the recalling of recent experiences was an outward roaming in time. Examples are the following: "Stimulus word 'eraser,' reaction word 'lamp.' Introspection: 'Visual pencil suggested, then no further associations; process of hunting around out-doors for something to say; came to arc light by lodge.'" "Stimulus word 'broom,' reaction word 'piano.' Introspection: 'Had no associations. Went wandering around the halls, then into Assembly Hall and saw piano."

(3) In another set of cases the reaction word is derived from verbal perseveration. This set may be subdivided in the following way. (a) Sometimes the reaction word is itself a perseveration. There were four subclasses under this head. The first subclass com-

prises those instances where the reaction word is a recurrence of a preceding reaction word. There were altogether six examples of this: in all of them the previous occurrence of the reaction word was at least six experiments back. In every case the reaction word was recognized by the observer, in giving it, as having been given before. The cases were as follows: "Pipe-pencil" (previous day); "maze-steamship" (12 experiments before); "game-bush" (7 experiments before); "canoe-bird" (6 experiments before); "fur-silver" (six weeks before); "frame-appletree" (apple one month before). The second subclass includes those cases where the reaction word is a recurrence of a previous stimulus word. There were three such instances: "hammer-nest" (7 experiments before); "umbrella-cane" (3 experiments before); "easel-canoe" (2 days before). "Umbrella-cane" was really a direct association, and was criticized by the observer as "too near" as soon as she had given it, but she also recognized the influence of the stimulus word "cane" which had been used shortly before. A third subclass includes cases where the reaction word was one recognizd by the observers as having been used in recent experiments of a different kind; there were three such cases, namely, "roof-float;" "teapot-hen;" "orchard-barouche." In the fourth subclass we have placed three examples from one observer, W, who is of a decidedly motor-verbal type, of the use of words as reaction words which have a general tendency to recur in all experiments of any sort with this observer: favorite words as it were. The cases were: "net-holiday," "key-sermon," "trout-star," "school-comet."

(b) Sometimes the reaction word, while not itself a perseveration, is suggested by association with a word which perseverates. The association may be either through sound or through meaning, and as before, the word which perseverates may be either a former stimulus word, or a former reaction word, or a word from some other source. There were six cases where the reaction word was suggested by sound association with a former reaction word which perseverated. They were the following: "Floor-capitol," from sound of "candle," reaction word 7 experiments back; "Canopy-fringed," from sound of "fright," r.w. on previous day; "Whistle-billow," from sound of "willow," a favorite word of the observer's, used as r.w. three experiments before; "Bush-stand," from "strain," r.w. on the previous day; "clock-answer," from sound of "absence," preceding r.w.; "Alcohol-arrest," from sound of "absence," r.w. 5 days before. There were also six cases where the reaction word was suggested through association with the meaning of a previous reaction word which perseverated. They were: "Broom-candle," from "silver," preceding r.w.; "Pencil-bluebird," from "willow," preceding r.w. and a favorite word of the observer's; "Sermon-rubber-tire," from "popgun," preceding r.w.; "Stone-sparrow," from "willow," favorite word; "Key-orange," from "pink," r.w. 10 experiments before; "string-kite," partly direct, but influenced by preceding r.w. "boy." There was one case where the reaction word came through sound association with a preceding stimulus word which perseverated: "Ladder-violet," through sound association with preceding s.w. "violin." There were three cases where the reaction word was suggested by meaning association with a perseverating stimulus word; as follows: "Jabot-tree," the reaction word suggested from the previous stimulus word, "camp;" Match-snow," from the stimulus word "sled," three experiments back; "Umbrella-bird," from the preceding stimulus word "net." It may be noted that in this gen-

eral class (b), where the reaction word is not itself a perseveration but is suggested by a perseverating word, the word which perseverates is apt to be of more recent occurrence than in class (a). There were eight cases under class (b) where a word perseverating from the preceding experiment exerted an influence, and no case under class (a) where a word occurring less than six experiments previously recurred. This is probably due to the influence of the *Aufgabe:* in seeking unassociated words, the actual repetition of recently occurring stimulus or reaction words would be avoided, but their influence is exerted indirectly through association.

(4) Closely allied to the perseveration of words is the apparently spontaneous occurrence of certain letters as initial letters for the reaction word. In all the experiments performed there were fourteen such cases: the following may serve as examples: "Stimulus word 'string,' reaction word 'lace.' This sound persisted and was inhibited: l came." "Stimulus word 'easel,' reaction word 'rain.' J's and s's inhibited; r chosen." The experience seemed to be that of inhibiting meanings in general and trying for something purely auditory-motor: why several initial consonants should sometimes be inhibited or rejected before one was finally "allowed" to suggest a word, the observers themselves could not explain.

(4) In a very large number of cases no reason whatever could be obtained from the introspections of our observers for the occurrence of the reaction word. For the observers who were most thoroughly tested the percentages of such unexplained reactions were as follows: A. (155 experiments in all), 43% unexplained; Ab. (72 experiments), 30% unexplained; B. (164 experiments), 26% unexplained; Ch. (35 experiments), 25% unexplained; Cr. (71 experiments), 43% unexplained; S. (32 experiments), 40% unexplained; W. (61 experiments), 28% unexplained; Y. (34 experiments), 70% unexplained. Observer Y had had no previous training in introspection, which may in part account for her high percentage; W had had more than the others, Ab. came next, and the rest were equal as regards their introspective experience. A few examples of these unexplained reactions may be quoted.

Observer W. "Stimulus word 'soup,' reaction word 'tragic.' 'Soup of the evening' came verbally, image of Mrs. K. Inhibited; impulse to think of abstract word: 'tragic' came purely as auditory-motor word."

Observer W. "Stimulus word 'path,' reaction word 'salmon.' Faint visual images of path to Sunset Hill and words 'Sunset Hill.' Inhibited: 'salmon' purely auditory-motor."

Observer A. "S.w. 'sled,' r.w. 'figure.' No associations suggested by s.w.; r.w. came purely as a word, without images."

Observer S. "S.w. 'door,' r.w. 'circle.' Word 'gate' inhibited; visual image of a circle came without apparent connection."

Observer Cr. "S.w. 'saucepan,' r.w. 'ring.' Stimulus word inhibited at once; got visual picture of gold ring."

How is the occurrence of the reaction words in all these cases to be accounted for, when the observers themselves can give no explanation of it? In a good many cases, probably, better introspection would show that some recent experience is responsible for them, and that the instances belong, therefore, to the class which we have numbered (1). In other cases the reaction words may be verbal perseverations not recognized as such. To call an idea, whether verbal or otherwise, a perseveration is, however, only partially to explain its occurrence. In so far as it has been recently or fre-

quently in the mind, we know that it has a certain readiness to recur at the bidding of slighter causes than would produce it if its previous occurrence were of earlier date or rarer; but of what causes actually do produce it we declare ourselves ignorant when we call it a perseveration. Since those causes do not appear in consciousness, we must think of them as merely physiological processes, and the question whether they are of the same nature as the processes which underlie association,—whether the cases in question are really, that is, mediate associations,—or whether they consist in the "spontaneous" recurrence of activity in certain neurone groups, is one we cannot answer.

(5) In a certain number of the experiments the stimulus word and the reaction word were really associated quite directly, but the observer did not recognize the fact at the time the reaction word was given. She believed herself to be obeying the instructions and giving an unassociated word, but immediately after pronouncing the reaction word she realized that it was not unassociated, but connected immediately with the stimulus word. It is not possible to draw a hard and fast line between cases of this type and true mediate associations, as we interpret the latter term. The distinguishing mark which we have attempted to apply is this: in cases of the type now being discussed the association between stimulus word and reaction word is direct, although not recognized at the moment when the reaction word occurs to the observer's mind. In cases of mediate association the connection between stimulus word and reaction word is through a well-marked intermediate link, which is not in consciousness at the time when it functions to connect the two. Probably in the cases which we are now considering, of direct though unrecognized connection between stimulus word and reaction word, the instructions are responsible for the fact that the connection *is* unrecognized. The observer is told to avoid associations with the stimulus word: the way to avoid associations is to direct attention away from them, and thus to ignore them when they are present. The following may serve as illustrations of this class of cases.

Observer Ab. "'S.w. 'net,' r.w. 'rush.' Tennis images inhibited: mind a blank; after giving r.w. realized its association with tennis."

Observer Cr. "S.w. 'game,' r.w. 'tree.' Saw small balls and discs used in game; then had basket-ball associations, inhibited them, saw a tree; after giving word realized that it was the tree on the basket-ball field."

Observer A. "S.w. 'violin,' r.w. 'Easter.' Both were mere words, with no apparent association, but after giving r.w. thought of Easter music in which a violin was played."

Observer Ch. "S.w. 'fork,' r.w. 'lemon.' Images of spoons, knives, *etc.*, then absolute inhibition. Then visual picture of lemon; after giving word saw lemon fork on dish of sliced lemon."

(6) We come now to the cases of true mediate association found in these experiments. Before quoting them we must take account of one consideration. We have just said that probably the occurrence of the cases classified under (5) is due in part at least to the influence of the instructions. Stimulus word and reaction have a direct, conscious association, from which, however, attention is diverted in consequence of the instructions. As soon as the reaction word is given, the association between it and the stimulus word is attended to. Now in a mediate association, on the other hand, we are supposing that the link between stimulus word and reaction word is a more complex affair, and that it is not a conscious affair, but a

purely physiological process. If the case is recognized as one of mediate association, however, and does not have to be relegated to the "unexplained" class, the link occurs to the observer's mind afterwards. But may we not say, then, that in these so-called mediate associations too the link was really present *in consciousness* at the time when it functioned, but was unattended to because of the influence of the instructions? If such be the case, our mediate associations would not deserve the term, because the link would not be purely physiological.

It is not possible to meet this objection with a sharply defined answer, because we are dealing with matters of degree. Who could assert that a process responsible for the succession of one idea upon another is wholly physiological, unaccompanied by even the faintest trace of consciousness? The question as to whether we have obtained in these experiments true instances of mediate association may be held to turn upon another: how much ignoring of processes really in consciousness can be ascribed to the influence of the instruction in our experiments? To recur to the sample of our mediate associations which we gave at the beginning of this article: is it conceivable that the picture, of upturned trees and general devastation seen from the car window, which linked together "south" and "storm," could have been present in consciousness at the time of its functioning as a link, and have been completely unattended to because of the influence of the instructions not to associate? But perhaps, it may be argued, the whole picture did not need to be there in order to establish a connection on the conscious level; some fragmentary process might have represented it in consciousness, might have been ignored by attention, and might still have formed a psychological link, so that no mediate association, or association by purely physiological intermediaries, occurred. Now at this point we are brought face to face with the whole fundamental problem regarding the trustworthiness of introspection. When, after the reaction word has been given, the observer brings into mind the idea of the picture from the car-window, which represents the link, does her introspection, recalling the experiences that intervened between stimulus word and reaction word, discover there any traces of a conscious process representing in any way this link? If it does not, and if it is practised introspection, then to deny its authority is no more and no less than to reject what many of us regard as the fundamental psychological method. It may often be hard to decide whether a given case should be classified as a mediate association or under class (5), just discussed. But there is, after all, a difference between the two classes: in the cases which properly belong under class (5) the observer's introspection, recalling the experiences between stimulus word and reaction word, recognizes that the link was there in consciousness, although not attended to sufficiently to reveal the fact that it was a link; in the true cases of mediate association the observer can find no trace of the intermediate process whatever on reflecting on the contents of the interval between stimulus word and reaction word.

Out of the 662 experiments we made, 77, or 11.6%, gave us cases which we counted as mediate associations. For the observers upon whom the greater number of the experiments were performed, the percentages of mediate associations were as follows: A., 9%; Ab., 19%; B., 7%; Ch., 8%; Cr., 12%; S., 15%; W., 16%; Y., 14%. There follow one or two typical cases from each observer:

Observer W. (who had had much more practice in introspection than any of the others). "S.w. 'saucepan,' r.w. 'birthday.' Vague pictures of observer's room, and of dishes as they had recently been taken from a closet and placed on the table. Inhibited. Word 'birthday' came purely as a word, auditory-motor. Afterwards the connection was traced as follows: the observer had been talking of birthdays that morning with a person some of whose dishes are now in the observer's closet."

"S.w. 'cowboy,' r.w. 'Sunday.' Several words associated with the s.w., among them '101 Ranch,' were inhibited. A blank followed, and then the word 'Sunday' came, purely as an auditory-motor word. Afterwards the observer remembered that on the previous Sunday while in a street-car she had heard people behind her talking of '101 Ranch.'"

Observer Ab. (whose practice in introspection covered several years). "S.w. 'cello,' r.w. 'Frank.' Several visual images and words connected with music occurred and were inhibited. The word 'frank' came with the adjective meaning attached. Afterwards, the word became a proper name, that of a professor of music among the observer's acquaintances."

"S.w. 'newsboy,' r.w. 'ocean.' Ideas of the *Tribune's* dinner for newsboys occurred and were inhibited. The word 'ocean' came accompanied by a visual picture of the ocean. The observer then remembered reading in the *Tribune* an account of the stranding of the *Princess Irene.*"

Observer A. "S.w. 'bell,' r.w. 'Egypt.' The words 'class bell, Rockefeller Hall,' were suggested; then a blank due to inhibition, then the auditory-motor word 'Egypt.' Afterwards she remembered that Egypt had been mentioned in a class in Rockefeller Hall that morning."

Observer B. "S.w. 'ruffle,' r.w. 'cadet.' A few associations with s.w. inhibited. After giving r.w., remembered having seen a girl starting for West Point that morning with ruffles on her coat."

Observer Ch. "S.w. 'match,' r.w. 'Miss E.' Ideas connected with lighting match inhibited. 'Miss E.' came verbally. Afterwards the word 'maps' came [Miss E. is a professor of history] and its sound association with 'match' was recognized."

Observer Cr. "S.w. 'dustpan,' r.w. 'circus.' Associated images of brooms inhibited. Visual image of circus ring presented itself. Afterwards realized that the connecting link had been 'dust.' (This case perhaps belongs in class (5). Observer Cr. gave few good instances of mediate associations).

Observer S. "S.w. 'pail,' r.w. 'out-of-doors.' Associations with 'pail' inhibited. Picture of 'out-of-doors' as seen from corridor window. Immediately afterwards remembered hearing lately of a certain Dutch painter who always put a pail in the foreground of out-of-doors scenes."

Observer Y. "S.w. 'theatre,' r.w. 'classroom.' Visual images connected with opera inhibited. Visual picture of a classroom; after giving word realized that it was the *music* classroom, from which the observer had just come." (This case, also, might be interpreted as belonging to class (5). Observer Y. had had no practice in introspection).

Of course the possibility must not be overlooked that some of our supposed mediate associations are *ex post facto;* that is, that after the reaction word has been given, and the stimulus word is recalled, an association is made between them which had no function, either

physiological or psychological, in producing the reaction word. Yet to suppose that this was regularly the case would be to leave the origin of the reaction word completely unexplained. It certainly seems likely that in the majority of cases where a reaction word occurs with no other demonstrable reason for its occurrence, the reason is to be found in a link which immediately afterwards presents itself to the observer's consciousness: the burden of proof would lie upon the person who should deny such an explanation. Very likely some of the cases which we classed as mediate associations do not properly belong under that heading. But we are convinced that the method furnished us with a number of associations whose link was physiological rather than psychological.

The peculiar feature of our method lies in the nature of the instructions given to the observer, and it will be well to summarize in closing the effects which those instructions had. The instructions set up, as it were, a barrier against the occurrence of the series of processes that would have followed upon the stimulus word in ordinary association experiments. What was the nature of the processes which, to continue the figure, got past the barrier? They were, briefly, the following:

(a) Sound associations. The instructions diminished attention to meanings, since through meanings associations most conspicuously arise, and sound associations consequently took on increased influence.

(b) Perseverating ideas from recent experiences. The checking of the train of ideas which would be naturally suggested by the stimulus offered an opportunity for these to assert themselves.

(c) Perseverating reaction words, and to a less degree perseverating stimulus words, but not those used in immediately preceding experiments.

(d) Words associated through sound or meaning with perseverating reaction or stimulus words, even those of the experiment immediately preceding.

(e) Directly associated ideas which are, however, not sufficiently attended to to make the fact of their association clear: this failure to conform to the conditions of the experiment is probably due to the instructions themselves, which naturally have a tendency to direct attention away from the ideas suggested by the stimulus word, and in these cases simply allow the associative connection to be overlooked.

(f) Ideas which are connected with the stimulus word by an intermediate process which has no conscious accompaniment: mediate associations.

XIX. A Study of the Images Representing the Concept "Meaning"

By Mary W. Chapin and M F. Washburn

"I see meaning as the blue-grey tip of a kind of scoop, which has a bit of yellow above it (probably a part of the handle), and which is just digging into a dark mass of what appears to be plastic material. I was educated on classical lines; and it is conceivable that this picture is an echo of the oft-repeated admonition to 'dig out the meaning' of some passage of Greek or Latin. I do not know; but I am sure of the image. And I am sure that others have similar images. I put the question not long since to the members